Initial Study Task

Mark Herring / Jordan Camp

Topics

- Purpose of Initial Study Task
- Schedule and Format
- Task Description

Purpose of Task

- Tool to allow project staff to learn more about industry capabilities
- Supports generation of RFP
- Supports bidder efforts to learn more about LISA

Schedule and Format

- Response requested in Slide Show format
  - Submit PowerPoint or PDF file
- Charts due June 30, COB
  - E-mail to list provided
- Individual Bidder Presentations at GSFC July 1 and 2
  - Two hours for presentation
  - Q&A period
- Follow-up written report due July 15
  - Approximately 25 pages

Implementation Assumptions

- The study task is based on the LISA architecture and implementation planning described in the TRIP Report and in this briefing.
  - In case of conflict, this briefing prevails
- The assumptions can and will change before the RFP is issued---and throughout the formulation phase

Task Description

- One function of the System Engineering Office (SEO) is to ensure the technical integrity of the LISA mission. How do you plan to support the SEO in overall SE Management including coordination & communication, documentation, I&T planning and execution?
- ITAR Considerations: Given the integrated nature of LISA (both technical and teaming arrangements) and the structure of the Systems Engineering Office (IST&ITT), what is your approach to handling ITAR efficiently? How will information be exchanged between the relevant partners in a timely fashion?
- Describe a possible approach for integrated constellation testing that includes the setup and laser link acquisition strategy and normal science mode operations.
- Address the specific technical questions in the following charts

Technical Tasks

- LISA I&T program will involve a large number of detailed technical tasks to ensure proper assembly of spacecraft
  - interferometry, thermal, vacuum, etc....
- We would like to get some feeling for the technical capabilities of the contractors
- Thus we ask the contractors to provide *conceptual descriptions* of how they would go about verifying a number of mission requirements
  - estimate of cost, time, equipment, and manpower

Proof Mass Enclosure Vacuum

- After bakeout, the proof mass enclosure vacuum level must meet the following requirements
  - total pressure < 10^{-7} torr
  - hydrocarbon partial pressure (AMU > 44) < 10^{-10} torr
  - gas 'bursts' of pressure > 10^{-7} torr over 1000 sec, at rate < 1 / day
- Assumptions
  - enclosure has a volume of 0.03 liter
  - enclosure pumped by a 10 liter / sec ion pump
  - access to the enclosure provided by a connection with 10 liter / sec conductance

Output Beam Wavefront

- After magnification by the expanding telescope, the output beam wavefront distortion must meet the following requirement
  - Peak-peak deviation from a planar wavefront < $\lambda / 50$
- Assumptions
  - beam has 30 cm diameter after exiting spacecraft
  - ignore obscuration at center of beam from Cassegrain design

Laser Noise

- The noise on the laser light must meet the following requirements at 1 mHz
  - intensity noise $\Delta I / I < 10^{-5}$ / sqrt (Hz)
  - frequency noise $\Delta f / f <$ 30 Hz / sqrt (Hz)
  - pointing noise 1 m from proof mass < 1 micron / sqrt (Hz)
- Assumptions:
  - output beam diameter of 1 mm (telescope not yet installed)
  - laser is frequency stabilized and exits spacecraft after being reflected off of fixed proof mass.

Temperature Variation at Proof Mass

- The temperature variation at the proof mass, on orbit, must be < 10-6 K / sqrt(Hz) at 1 mHz
- Assumptions:
  1. spacecraft temperature variation on orbit = 10-3 K / sqrt (Hz)
  2. I&T room temperature variation = 10-1 K / sqrt (Hz)
  3. test is done with SC fully assembled